

## CLAIMS

1. A production method of a dehydration reaction product which comprises a dehydration reaction step of subjecting 5 a reaction solution containing a polymerizable compound to the dehydration reaction,  
said dehydration reaction step comprising using a dehydration reaction apparatus,  
said dehydration reaction apparatus comprising a 10 reaction vessel, a condenser and a connecting pipe joining said reaction vessel with said condenser and satisfying the requirement:  
0.05 <  $(B^3/A) < 35$   
where A is a capacity ( $m^3$ ) of said reaction vessel and B is a 15 total length (m) of said connecting pipe on the horizontal basis.
2. The production method of a dehydration reaction product according to Claim 1,  
20 wherein the capacity A ( $m^3$ ) of said reaction vessel is 0.1 to 100  $m^3$ .
3. The production method of a dehydration reaction product according to Claim 1,  
25 wherein said pipe has a gradient ( $\theta$ ).
4. The production method of a dehydration reaction product according to Claim 1,  
30 wherein said gradient ( $\theta$ ) is 0.3 to 70°.
5. A production method of a dehydration reaction product to be applied to a production of a polymer for cement additives which comprises a dehydration reaction step of using a 35 vertical multitudular heat exchanger in producing the dehydration reaction product from a reaction solution,

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said vertical multitubular heat exchanger exchanging heat between an extratubular fluid and a distillate from said reaction solution and

5 having a structure comprising a body having an  
extratubular fluid inlet and an extratubular fluid outlet,  
covers provided at both upper and lower ends of said body,  
tubesheets provided in the vicinity of the both upper and lower  
ends of inside of said body and a plurality of heat exchanger  
tubes connected between said tubesheets, and

10 no substantial retention areas for said distillate  
occurring on a connecting site between said tubesheet and said  
heat exchanger tube.

6. A production method of a dehydration reaction product  
15 to be applied to a production of a polymer for cement additives  
which comprises a dehydration reaction step of using a  
vertical multitubular heat exchanger in producing the  
dehydration reaction product from a reaction solution,  
said vertical multitubular heat exchanger exchanging  
20 heat between an extratubular fluid and a distillate from said  
reaction solution and  
25 having a structure comprising a body having an  
extratubular fluid inlet and an extratubular fluid outlet,  
covers provided at both upper and lower ends of said body,  
tubesheets provided in the vicinity of the both upper and lower  
25 ends of inside of said body and a plurality of heat exchanger  
tubes connected between said tubesheets, and  
30 no substantial protrusions of said heat exchanger tubes  
occurring on the surface, with which said distillate comes into  
contact, of at least a tubesheet provided in the vicinity of  
the upper end out of said tubesheets.

7. The production method of a dehydration reaction product according to Claim 5 or 6,  
wherein an antigelling agent is caused to act on said

distillate when carrying out the dehydration reaction step by exchanging heat between the distillate and the extratubular fluid using said vertical multitubular heat exchanger.

5        8. The production method of a dehydration reaction product according to Claim 5 or 6,  
      wherein said reaction solution contains (meth)acrylic acid and/or a dehydration reaction product derived therefrom.

10        9. The production method of a dehydration reaction product according to Claim 1, 5 or 6,  
      wherein said dehydration reaction step comprises a step of subjecting a reaction solution containing an alcohol and (meth)acrylic acid to esterification reaction to form an ester  
15        and/or a step of subjecting a reaction solution containing an amine and (meth)acrylic acid to amidation reaction to form an amide.

20        10. A production method of a dehydration reaction product  
      which comprises a dehydration reaction step of subjecting an alcohol and/or an amine with (meth)acrylic acid to esterification and/or amidation in the presence of a dehydrating solvent,

25        said dehydration reaction step comprising using a reaction vessel and a water separator,  
      said water separator being provided with a feeding pipe connected with said reaction vessel, and  
      having a gaseous phase section and a liquid phase section  
30        therewithin, and  
      said feeding pipe having openings in the gaseous phase section and in the liquid phase section.

35        11. The production method of a dehydration reaction product according to Claim 10,

wherein the opening of said feeding pipe in the gaseous phase section comprises one or a plurality of holes made on the side face of said feeding pipe.

5 12. The production method of a dehydration reaction product according to Claim 10,

wherein said water separator is provided with a baffle plate and the opening of said feeding pipe in the gaseous phase section is in the direction opposite to said baffle plate.

10 13. A production method of a dehydration reaction product

which comprises a dehydration reaction step of subjecting an alcohol and/or an amine with (meth)acrylic acid to esterification and/or amidation in the presence of a dehydrating solvent,

said dehydration reaction step comprising using a reaction vessel and a water separator, and

20 said water separator being provided with a feeding pipe connected with said reaction vessel,

having a gaseous phase section and a liquid phase section therewithin,

having smaller diameter in a lower portion thereof than a diameter in an upper portion and

25 being so controlled that an interface between the dehydrating solvent and byproduct water is maintained in a lower portion thereof.

14. A production method of a dehydration reaction product

which comprises a dehydration reaction step of subjecting an alcohol and/or an amine with (meth)acrylic acid to esterification and/or amidation in the presence of a dehydrating solvent,

35 said dehydration reaction step comprising using a

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reaction vessel and a water separator,  
said water separator being provided with a feeding pipe  
connected with said reaction vessel,  
having a gaseous phase section and a liquid phase section  
5 therewith and  
being provided with a detection device of an interface  
between the dehydrating solvent and byproduct water and/or a  
gas/liquid interface, and  
an antigelling agent being caused to act on inside of said  
10 detection device.

15. The production method of a dehydration reaction  
product according to Claim 10, 13 or 14,  
wherein said alcohol is represented by the following  
15 general formula (1):  
$$R^1O(R^2O)_nH \quad (1)$$
  
in the formula,  $R^1$  represents a hydrocarbon group containing  
1 to 30 carbon atoms,  $R^2O$  are the same or different and each  
represents an oxyalkylene group containing 2 to 18 carbon atoms  
20 and  $n$  represents an average number of moles added of the  
oxyalkylene group represented by  $R^2O$  and is a number of 0 to  
300.

16. The production method of a dehydration reaction  
25 product according to Claim 1, 5, 6, 10, 13 or 14,  
wherein said dehydration reaction product is used as a  
starting material for a production of a polymer for cement  
additives.

30 17. A dehydration reaction apparatus  
which is to be used in the production method of a  
dehydration reaction product according to Claim 1, 5, 6, 10,  
13 or 14.